

# TRENDS AND DRIVERS IN EARLY-STAGE ENERGY TECHNOLOGY INVESTING

by

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## Executive Summary

This report seeks to identify and discuss the key drivers behind major trends in early-stage energy technology investing. We conduct intimate interviews with a group of prominent investors, and analyze and discuss results to reach conclusions about trend lifecycle and future implications. The three major trends identified in this project through literature review include:

- (1) An increase in corporate venture capital activity
- (2) A decrease in overall venture investment in the sector
- (3) An ongoing difficult environment for raising new energy-focused funds

Eight in-depth interviews with energy technology venture capital investors – varying in fund size, location, and investment style revealed a shift in early-stage energy technology investing. We expect venture capital firms in the space to diverge. Some firms will likely specialize in energy technology and find success in technology innovation investments due to their sector-specific expertise. Other more generalist firms will be forced to focus on capital-efficient investments in downstream energy technology innovations, where they can achieve investment cycle and return profiles similar to pure technology plays. Gaps in funding can be filled by newly interested corporate venture capital firms (CVCs), which provide strategic advantages to start-ups and spur a new wave of innovation. We are optimistic that early-stage energy technology investors will be able to achieve

significant returns for years to come, based on our analysis of the major trends and drivers discussed in this project.

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## Introduction

Energy technology investors look to reap financial returns via equity and debt investments in energy technology companies throughout all stages of the business cycle. These investors realize that global energy demand is growing, but resources are limited. Many trends observed today across the energy technology industry imply that large-scale renewables alone are no longer the key focus of investors due to the magnitude of capital costs, regulatory uncertainty, and time required to take products to market. Private energy technology investors are now diversifying into adjacent sectors such as transportation, water, and agriculture, along with enabling technologies (see glossary). These enabling technologies include batteries, smart grid applications, automation software, advanced turbines, and any other innovation that would complement and motivate efficiency and the use of renewables.

Venture capital funding from private investors has retreated from the energy technology sector in recent years, and corporate investors are filling the funding gap. Although corporate venture capital (CVC) funds are increasing the amount of capital invested into the space, overall deal size and frequency has decreased, and a number of private venture capitalists are struggling to raise their next energy-dedicated funds.

This project identifies through a literature review, then discusses, three major trends in early-stage energy technology investing. These trends are: (1) an increase in corporate venture capital activity, (2) a decrease in overall venture investment in the sector, and (3) an ongoing difficult environment for raising new energy-focused funds.

A few existing reports have testified to the existence of these trends (see Table 1), but have not discovered nor discussed the attitudes and opinions of investors, on aggregate, to better understand the expected lifecycle of these trends and how venture investors are adjusting to the changing investment landscape and environment.

To explore the prevalence and key drivers of these trends, we conduct eight intimate interviews with prominent energy investors. We then analyze and discuss interview results to better understand trend lifecycle and future implications.

## Early-Stage Energy Technology Investing

### Definitions

For the purposes of clarity and consistency, we define our use of the following terms below. These definitions apply only to this report, and may vary across other resources.

### *Energy Technology*

“Cleantech” is a term often used to define a set of opportunities and innovations related directly to renewables (e.g. wind turbines and solar PV panels) and their enabling technologies (e.g. batteries or AC/DC inverters). By some standards, “cleantech” also includes applications to adjacent sectors, such as transportation, air quality control, and wastewater management.

In this report and throughout our research subject interviews, we purposefully do not use the term “cleantech,” but instead employ the term “energy technology.” We consider energy technologies to offer a broader range of resource advantages, such as building materials, financing tools, smart grid applications, and other applications for traditional energy source use. These energy technologies are “inclusively defined as technologies that harness new or alternative energy sources (fuel cells, solar panels, submarine watermills), enhance the efficient or non-polluting use of energy, or improve the reliable delivery of energy, such as enhancements to the high-voltage power grid” (Watikiss, 2005).

Most of the secondary resources cited throughout this report provide information related only to their respective definitions for “cleantech” (Table 1). We explored definitions, terminology, and data resources used across the industry. We found that each organization or report defines “cleantech” with varying scopes and standards. Therefore, we chose to employ the term “energy technology” to encompass findings of these outside reports as they relate to energy specifically, while disregarding opportunities that could be considered “cleantech,” but are not energy-specific. Use of our standardized “energy technology” lens for analyzing investment opportunities and interview responses enables consistency across research subjects, increases clarity of research objectives, and provides a specific focus on energy sector findings.

For illustrative comparison purposes, Cleantech Group defines “cleantech” as a combined 18 sub-sectors in resource innovation , as seen in Figure 1 (Cleantech Group, 2013).



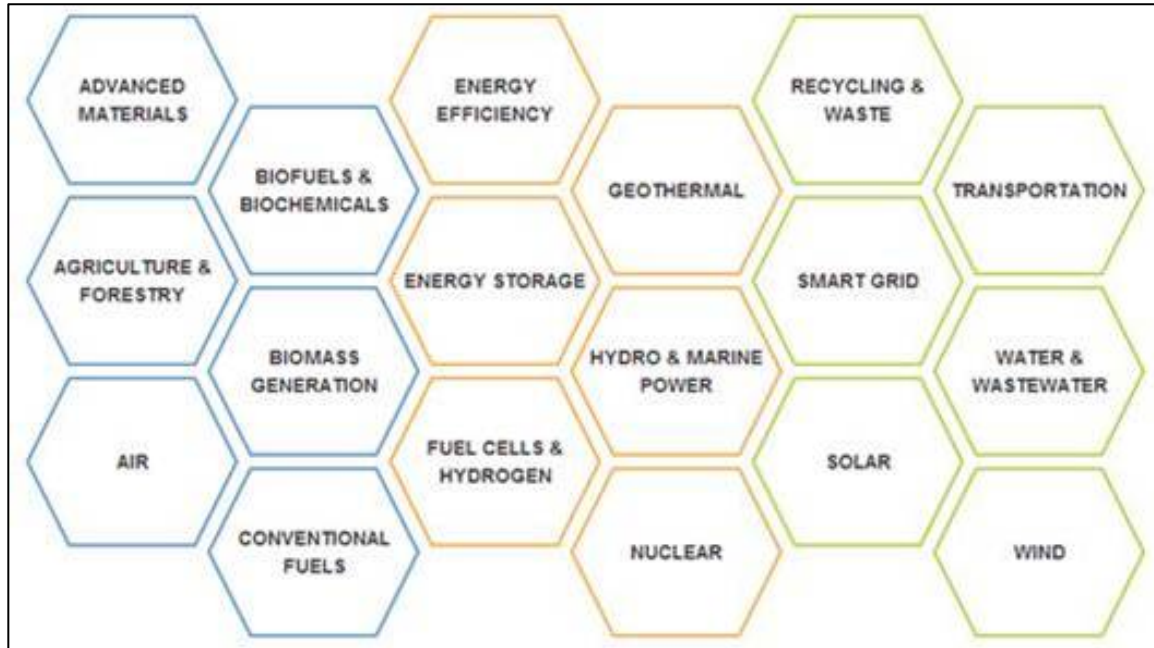


Figure 1: Cleantech Group sector analysis (Cleantech Group, 2013)

We further define “energy technology” using this framework, to encompass the following 13 sub-sectors:

- Biofuels & Biochemicals
- Biomass Generation
- Conventional Fuels
- Energy Efficiency
- Energy Infrastructure
- Energy Storage
- Fuel Cells & Hydrogen
- Geothermal
- Hydro & Marine Power
- Nuclear
- Smart Grid
- Solar
- Wind

## *Venture Capital*

Venture capital is a subgroup of the broader private equity industry. The purpose of private equity is to manage capital on behalf of a fund's limited and general partners by identifying opportunities to invest in privately-held companies and by generating substantial returns on those investments. Private equity can take the form of venture capital, growth equity, late-stage financing, project finance, leveraged buyouts, or secondary buyouts, depending on the growth stage and financial situation of the company to be financed. Companies receiving private equity funding typically cannot be financed with traditional bank financing, and are considered to be illiquid assets. Due to these and other risks, private equity investors expect a high rate of return on their investments (Thomson Reuters; National Venture Capital Association, 2013).

Venture capital refers to investment in early-stage companies (pre-commercialization or at commercialization of product or service) in exchange for a stake in the company based on an agreed-upon valuation. This stake in actuality is worthless until the company engages in an exit or other liquidity event (Thomson Reuters; National Venture Capital Association, 2013). These investments typically occur in a series of funding "rounds." For the purposes of this report, we consider early-stage venture capital investment to occur across Seed, Series A, Series B, and Series C rounds. These investments can typically be in the range of \$500k-\$15M, depending on the stage and needs of the company, as well as the investors' preference. Additionally, venture capitalists often take board seats in order to help

steer the direction of the company and use industry expertise to advise strategic decisions and key management team hires, which can increase the likelihood of success for the company and returns for the investor (Thomson Reuters; National Venture Capital Association, 2013).

Venture capital firms can vary by type, based on their investors and fund structure. Investors in a fund are known as limited partners (LPs). Venture capitalists manage LP money and also take a stake in the performance of their investments. These venture capitalists are referred to as general partners (GPs). LPs typically pay a 2.5% management fee to GPs, and returns on investments are split between the parties. In this report, we discuss and consider three types of venture capital firms:

1. Traditional or institutional venture firms, whose LPs are typically a mix of endowments, pension funds, and high net worth individuals.
2. Family offices, whose LP is a single high net worth family.
3. Corporate venture capital funds, which can function as a division of a large corporation, a separate fund backed by a large corporation, or as a joint venture between multiple organizations.

## History of Venture Capital Investments

As Figure 2 illustrates, investments in venture portfolio companies peaked during the dot-com boom of 1999-2000, and have not returned to that all-time high.

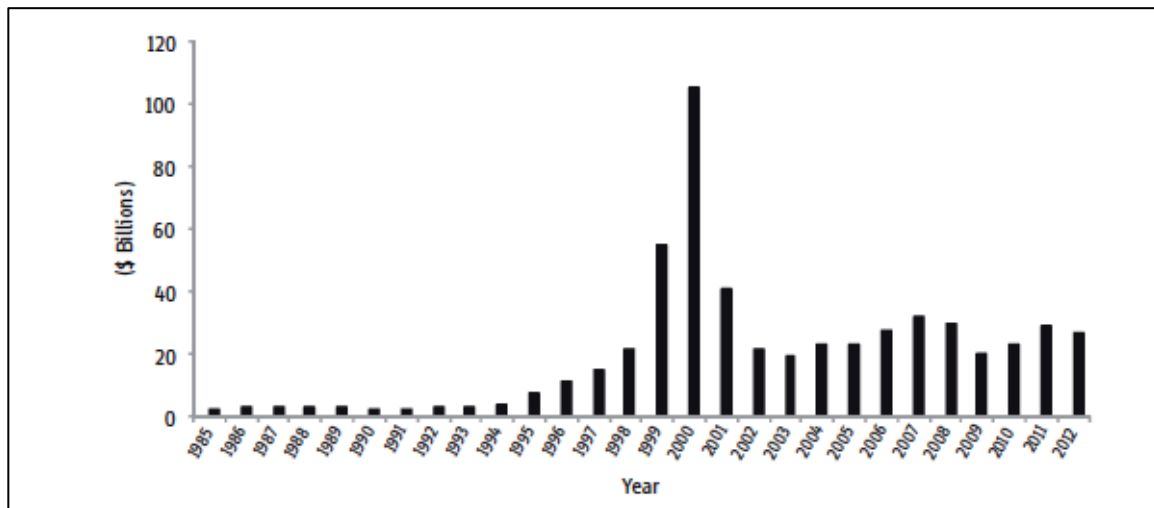


Figure 2: Investments by venture capital firms in portfolio companies, by year (Thomson Reuters; National Venture Capital Association, 2013)

In the early 1990's, venture-stage investors were generally not focused on alternative energy or resource efficiency (Day, 2012). Later that decade, early-stage investor attention turned to the Internet, and dot-com companies were poised to change the world and generate substantial returns. The influx of capital that VCs now had access to was overwhelming compared to the previous decade (see Figure 4), and ended up benefitting all sectors during early-stages of development, including energy technology (Day, 2012). In 2000, during the U.S. venture capital peak, 1,053 firms each invested \$5M or more (Thomson Reuters; National Venture Capital Association, 2013).

	1992	2002	2012
No. of VC Firms in Existence	358	1,089	841
No. of VC Funds in Existence	616	2,119	1,269
No. of Principals	4,996	14,541	5,887
No. of First Time VC Funds Raised	13	25	43
No. of VC Funds Raising Money This Year	78	176	162
VC Capital Raised This Year (\$B)	4.9	15.7	20.1
VC Capital Under Management (\$B)	28.7	272.1	199.2
Avg VC Capital Under Mgt per Firm (\$M)	80.2	249.9	236.9
Avg VC Fund Size to Date (\$M)	39.1	94.4	110.6
Avg VC Fund Size Raised This Year (\$M)	62.8	89.2	124.1
Largest VC Fund Raised to Date (\$M)	1,775.0	6,300.0	6,300.0

Figure 3: Changing fund dynamics over the last twenty years;  
((Thomson Reuters; National Venture Capital Association, 2013)

By summer 2003, energy technology venture capital investing had found support – the dot-com bubble had burst, the Northeast U.S. power grid had collapsed, and domestic natural gas prices had spiked (Watikiss, 2005). The residual amount of capital left in the system allowed U.S. venture capitalists to come back a few years after the crash and invest \$20.4 billion in 2004 across all sectors (Thomson Reuters; National Venture Capital Association, 2013) (The Economist, 2005). Energy companies did especially well in the public markets during this time, and more investors began to enter the sector as oil prices broke above \$50. In 2005, energy start-ups saw an uptick in early-stage investment and a rise in company valuations, as the amount of money put into venture capital by limited partners nearly doubled (Day, 2012).

According to the Cleantech Group, “from 2005 to 2008, the average size of a first round in the sector more than doubled from \$5M to \$13M, and the average size of a follow-on round rose from \$8M to \$26M” (Cleantech Group, 2013). Most of this investment went into high capital cost operations in biofuels and solar (Day, 2012).

Following the global economic meltdown of 2008, investment in the sector, and across venture overall, began to soften as energy technology companies did not meet profitability expectations, global demand diminished, and traditional hardware plays in renewables faced strong competition with China (Day, 2012).

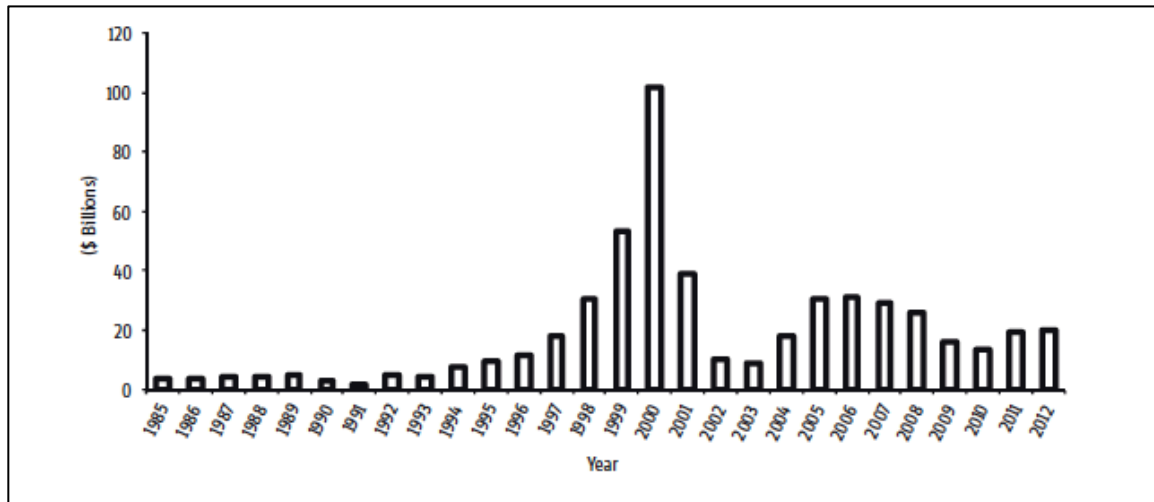


Figure 4: Capital committed to U.S. venture capital funds, by year (Thomson Reuters; National Venture Capital Association, 2013)

More recently, 2012 showed some positive signs for venture capital with a second consecutive year of increasing new commitments, totaling \$20.1 billion across 183 funds. Comparatively, this is about 67% of 2005-2007 levels, and 20% of 2000 levels (Thomson Reuters; National Venture Capital Association, 2013). Venture capital still prefers traditional capital-light investment opportunities such as software services, but industrial and energy sector investments still received over 10% of venture capital money in 2012 (Thomson Reuters; National Venture Capital Association, 2013). This may imply that these specific investments in energy and industrials are capital-efficient plays.

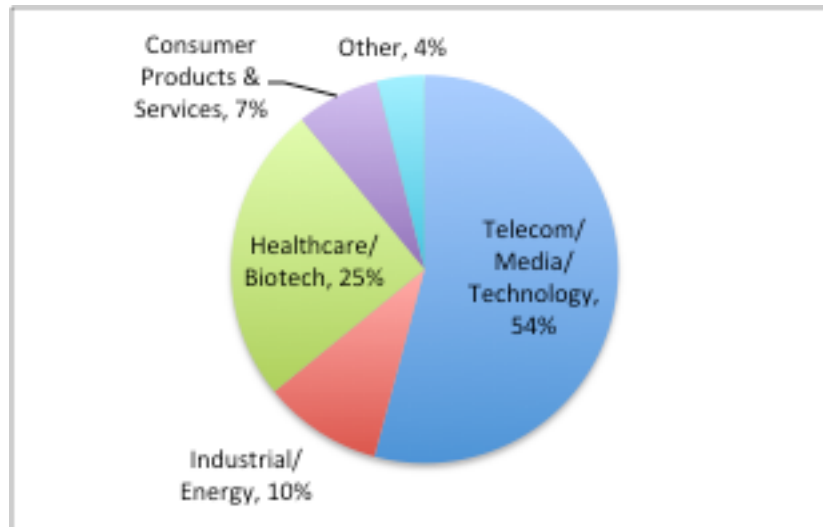


Figure 5: Venture capital investments by sector, 2012; (Thomson Reuters; National Venture Capital Association, 2013)

## Identified Industry Trends & Potential Drivers

Through secondary research, we have identified three emerging trends in energy technology: (1) an increase in CVC activity, (2) a decrease in overall energy technology deal activity, and (3) an ongoing difficult environment for raising new funds. These trends are explained in further detail below.

### Trend 1: Increase in Corporate Venture Capital Activity

Multiple industry reports indicate that while traditional venture investment is declining (see Trend 2), CVC funds have stepped in to fill this investment gap (Solazzo, Carey, Parsons, Haskins, & Gerstel, 2013) (Cleantech Group, 2013). While other sources of funding have also increased early-stage investment activity, such as family offices, corporations are establishing new in-house venture teams across industries (Bielesch, Brigl, Khanna, Roos, & Schmieg, 2012).

“Although venture funding is down, projects are being developed and the industry is growing overall, suggesting that other sources of funding, such as corporations, private equity, and commercial lenders, are becoming increasingly active.”

-Tom Solazzo, Cleantech Practice Leader at PricewaterhouseCoopers  
(Solazzo, Carey, Parsons, Haskins, & Gerstel, 2013)

Nearly 800 corporations worldwide invest in venture-stage companies either through their own venture unit or via another division internally, such as R&D (Bielesch, Brigl, Khanna, Roos, & Schmieg, 2012). This appears to be a new trend, as corporate venture capital funds were involved in 1,300 deals between July 2010 and June 2012 (Bielesch, Brigl, Khanna, Roos, & Schmieg, 2012). Energy-related



investments have especially benefitted from this growing source of capital, attracting \$1.9 billion in investments from a variety of industries including, but not limited to: information technology, financial services, telecom and media, as well as chemical companies (Bielesch, Brigl, Khanna, Roos, & Schmieg, 2012). For example, industrial sector CVCs allocated 52% and chemical sector CVCs allocated 37% of their transactions to clean technology. Energy technology is unique in attracting investment from a variety of industries because growth in the sector is expected to contribute to and enable future innovation development for myriad applications. In fact, corporate participation in clean energy technology deals has grown 108% from 2006 to 2011 (Cleantech Group, 2013).

This trend of increasing corporate interest in early-stage energy deals could be a reflection of several key motivations and drivers (Cleantech Group, 2013) (Bielesch, Brigl, Khanna, Roos, & Schmieg, 2012):

- Complement ongoing R&D efforts
- Penetrate new, high-growth markets
- Gain access to disruptive technologies and business models
- Acquire innovation that cannot be developed in-house with current internal resources
- Diversify exposure from core offerings and expand portfolio of core offerings
- Inspire additional innovative thinking across the organization
- Gain insight into companies for future investment or acquisition fit

- Generate financial returns outside of core business revenue streams

Additionally, these CVCs act as a strategic partner and can provide unique advantages to energy technology start-ups, including (Cleantech Group, 2013):

- Introduction to new customer, distribution, and geographic channels
- Validation for a company and its products to the market and other potential investors
- Assistance in establishing early paths to commercialization through financial assistance and institutional knowledge
- Access to research and development resources
- Access to large amounts of initial and follow-on capital in a difficult fundraising environment

Questions still remain, however, in regards to how institutional venture capital funds and family offices will adjust to this trend, if at all. There remains uncertainty and disagreement in the market regarding how long this trend may last and the implications it will have on the future of energy technology investing.

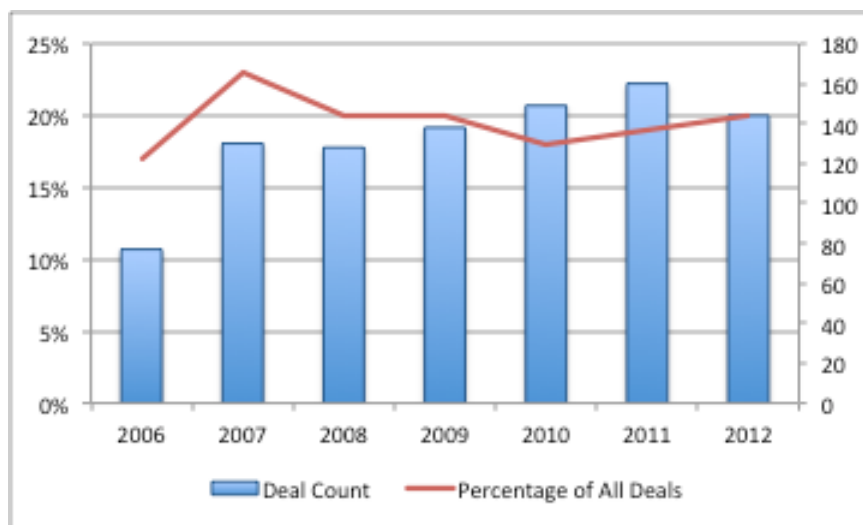


Figure 6: Corporate VC activity by deal participation and size (Cleantech Group, 2013)

## Trend 2: Decrease in Deal Size and Frequency

Given the widespread disagreement regarding what falls under “cleantech,” “energy technology,” or related sectors (see page 6), in addition to reporting differences across what is considered “early stage” (i.e. seed and series A only or inclusion of series B+), the data reflecting changes in deal activity varies slightly by source. A brief literature review shows, however, a generally decreasing trend across energy technology investments (Table 1).

<b>Publisher/Organization</b>	<b>Sectors/Stages Covered</b>	<b>Notable Findings</b>
Bloomberg New Energy Finance (Bloomberg New Energy Finance, 2013)	U.S. clean energy investment excluding government and corporate R&D; excluding digital energy asset and energy storage investment	-Investment peak in Q3'11 of \$20.3B -Severe decline in investment during FY'12 and Q1'13 -Recent uptick in Q3'13 with \$9.5B -Q3'13 is weakest quarter for VC/PE in the sector since 2005
Bloomberg New Energy Finance (Bloomberg New Energy Finance, 2013)	Global VC/PE new investment in clean energy	-Stable across 2011, with slight decline end of 2012 -Q1'13 uptick to \$2.4B; Q2'13 decrease to \$1.3B
Bloomberg New Energy Finance (Bloomberg New Energy Finance, 2013)	Global clean energy investment including digital energy asset and energy storage investment	-11% drop from 2011 high (\$317B) to 2012 (\$281B)
PricewaterhouseCoopers (Solazzo, Carey, Parsons, Haskins, & Gerstel, 2013)	Unclear	-Cleantech funding dropped more than overall VC funding in Q1'13 & Q2'13 -Q2'13 first-time funding dropped 95% YoY -Q2'13 follow-on funding dropped 58% YoY -Sub-sectors receiving less funding Q2'13 YoY: Smart Grid & Energy Storage (-86%), Solar (-81%), Agriculture & Bioproducts (-60%), Wind & Geothermal (-43%), Other cleantech (-42%)
Cleantech Group (Cleantech Group, 2013)	18 sectors (see Figure 1)	-Overall decreasing average VC deal size -Slight uptick in Seed & Series A funding in 2013 (Figure 7)

**Table 1: Literature review of energy technology venture capital deal size and frequency**

Some of the potential drivers behind this falloff in energy investments include

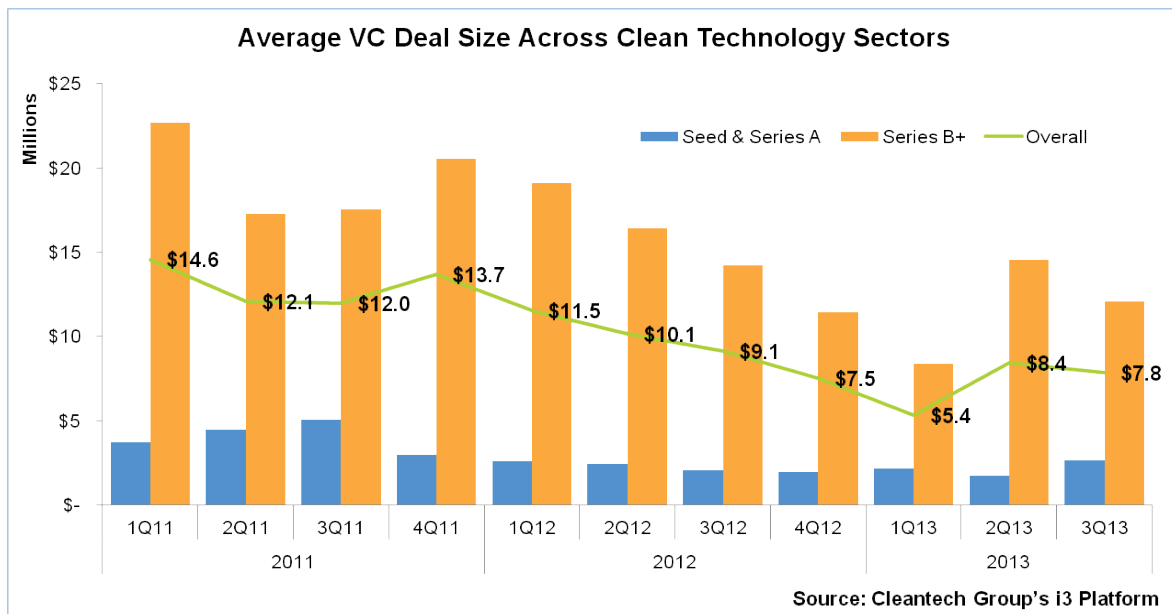
(Bloomberg New Energy Finance, 2013):

- Regulatory uncertainty leading to scalability issues (see page 38)
- Low domestic natural gas prices reducing demand for higher-cost renewables and their enabling technologies
- Lack of deal flow at attractive valuations, as venture firms will be unwilling to overpay

- Difficulty finding co-investors with industry expertise that can provide strategic advantages
- Unattractive IPO (initial public offering) and M&A (mergers and acquisitions) market environment, leading to a lack of exit opportunities

“The latest setback reflects policy uncertainty in Europe, the lure of cheap gas in the US, a leveling-off in wind and solar investment in China, and a general weakening of political will in major economies. Governments accept that the world has a major problem with climate change but, for the moment, appear too engrossed in short-term domestic issues to take the decisive action needed.”

-Micheal Liebreich, Chief Executive, Bloomberg New Energy Finance  
(Bloomberg New Energy Finance, 2013)



**Figure 7: Average clean technology venture capital deal size, by investment stage (Cleantech Group, 2013)**

### **Trend 3: Difficulty Raising New Funds**

Venture capital firms do not want to publicly announce that they are experiencing difficulty in raising new funds. However, a few reports have emerged uncovering the troubling environment in energy technology investing (Maag, 2013). For example, Hudson Clean Energy Partners failed to reach its \$1.5 billion goal, VantagePoint Partners cancelled fundraising for a \$1.25 billion fund, and Kleiner Perkins Caulfield & Byers restructured its green fund (Maag, 2013).

While many firms have been fighting an uphill battle, others have proven successful in their energy technology fundraising attempts. The Westly Group, for instance, recently raised a \$160 million fund, and SJF Ventures announced its third cleantech fund of \$90 million—three times as large as its second fund (Maag, 2013).

Additionally, based on the decreasing amount of capital invested (see Trend 2) and recent high-profile failures in energy technology (e.g. Solyndra, A123, Fisker Automotive), we hypothesize that VCs are indeed having difficulty fundraising. Additional support for this hypothesis comes from the diminishing emphasis that new funds are placing on “cleantech”, “clean energy”, and “renewable” focused portfolios. For example, Deloitte has even rebranded its annual Napa Valley Cleantech event as “Energy Tech” (CleanTechIQ, 2013).

To attract investors, venture firms are now widening their focus to include tangential sub-sectors they previously ignored, like agriculture, wastewater, and pollution prevention (CleanTechIQ, 2013).

## Interview Objectives

To explore the trends we identified above, we collected data through interviews across the energy technology early-stage investment community and conducted analysis of that data in order to identify key drivers of recent trends witnessed within the industry. Existing reports have proven the reality of these trends (see Table 1), but have not discovered nor discussed the attitudes and opinions of investors, on aggregate, to better understand the expected lifecycle of these trends and how venture investors are adjusting to the changing investment landscape and environment.



## Methods

### Interview Structure

Each interview was conducted for the purpose of gaining insight into investor attitudes to recent trends and specific adaptation strategies. By understanding how firms are adapting to the changing investment landscape, we expect to reach conclusions about the future environment for energy technology investing.

In order to achieve consistency across interviews in terms of length and format, we designed interviews to follow a standard structure:

1. Introduce project and gain consent to participate
2. Obtain information on firm (fund size, location, sector focus, investment thesis, etc.)
3. Discuss Trend 1: Have you noticed a shift from institutional to corporate investors? (Y/N)
  - a. Which is/are the biggest driver(s) of Trend 1?
    - i) Higher capital costs and longer investment cycles of energy technology start-ups,
    - ii) Access to innovation (business-line focus),
    - iii) Overall corporate strategy and competitive advantage, or
    - iv) Other?
  - b. How long will this trend last?

- i) Short-term,
- ii) Long-term, or
- iii) Cyclical?

c. How is your firm adapting to this trend?

d. What is/are the future implications of this trend?

4. Discuss Trend 2: Have you noticed a decrease in the number and size of deals in energy technology? (Y/N)

a. Which is/are the biggest driver(s) of Trend 2?

- i) Lack of attractive opportunities based on valuation,
- ii) Difficulty finding appropriate co-investors,
- iii) Unattractive market size and growth generally in the sector,
- iv) Concern around exit opportunities (acquisition or IPO) ,
- v) Capital is in short supply, or
- v) Other?

b. How long will this trend last?

- i) Short-term,
- ii) Long-term, or
- iii) Cyclical?

c. How is your firm adapting to this trend?

d. What is/are the future implications of this/these identified driver(s)?

5. Discuss Trend 3: Have you noticed an increasingly difficult environment for raising funds? (Y/N)

a. Which is/are the biggest driver(s) of Trend 3?

- i) Recent high-profile failures; bad public relations for the sector
- ii) Poor historical energy technology deal performance and poor returns
- iii) Long investment cycle for the sector
- iv) High capital costs requiring more invested funds, or
- v) Other?

b. How long will this trend last?

- i) Short-term
- ii) Long-term, or
- iii) Cyclical?

c. How is your firm adapting to this trend?

d. What is/are the future implications of this/these identified driver(s)?

6. Discuss broader investment environment and other topics not yet covered.

While this general structure was adhered to for each interview, the discussions deviated from the above format. This was mostly due to the conversational nature of interviews, and the existence of personal relationships with many of the research subjects. Due to this deviation in conducting the interviews and time constraints, many of the above questions were left unanswered. The nature of ongoing relationships and efforts to keep the interview conversational also may have also played a role.

For some research subjects, we sent an outline of the type of questions to be expected in the interview in advance. These occurrences translated to a greater adherence to the above structure. Others, however, participated on the fly, leaving more room for variance in responses and deviation from the intended interview script.

### Research Subject Analysis

The investors interviewed work for firms varying in fund size, type, sector focus, and geographical location. California and Massachusetts are the top two regions, by number of funds and capital committed for venture capital (Thomson Reuters; National Venture Capital Association, 2013). Thus, we strove to interview a mix of East and West Coast investors in order to understand if there were any differences in the trends that they were seeing in the market and how they chose to adapt, if at all.

State	(\$ Millions)
CA	93,814.8
MA	34,482.3
NY	21,378.0
CT	8,051.2
IL	4,369.0
Total*	162,095.4

*\*Total includes above 5 states only*

Figure 8: Dedicated venture capital under management, by state in 2012 (Thomson Reuters; National Venture Capital Association, 2013)

We also strove to interview a mix of investors across corporate, institutional, and family offices:

Identifier	Type	Location
1	Institutional	East
2	Institutional	East
3	Institutional	East
4	Family	West
5	Institutional	West
6	Institutional	East
7	Institutional	East
8	Corporate	East

**Table 2: Research subject descriptions**

## Results

### Research Subject Participation

Twenty-two venture capital firms were initially contacted to participate in this study. Each venture capitalist was then sent multiple follow-up emails to further explain the purpose of this study, describe the nature of the questions to be asked and the interview format, gain consent to participate, and schedule a call. Due to the sensitive nature of questions being asked, hesitation to participate in a public study, and general time constraints of venture capitalists, about ten preliminary emails were sent per interview finally conducted. Of the twenty-two venture capital firms initially contacted, eight of these firms consented to the interview and participated in our research study. To protect the anonymity of research subjects, we use identifying numbers 1-8 to refer to particular responses, as noted above in Table 2.

Of the fourteen investors that did not participate, three of these investors agreed to be interviewed, but an appropriately scheduled time could not be found due to investor scheduling conflicts and previously arranged travel, or we experienced sudden unresponsiveness to follow-up outreach efforts. The remaining nine investors who either did not respond to multiple contact attempts via email, or who declined to participate were all West Coast large institutional funds, with whom we did not have previously-standing professional relationships. This may imply that: (1) larger West Coast institutional funds do not see value in participating in such a research study, due to already fully understanding the market, (2) larger West Coast

institutional funds are more time-constrained than other types of funds, (3) larger West Coast Institutional funds are less comfortable sharing personal and firm-based investment theses with outsiders., and/or (4) a lack of strong pre-existing relationships play a role regardless of geography.

## Trend 1 Responses

Trend 1: Shift to Corporate Venture Capital					
Investor	Agree? (Y/N)	Driver	Timeline	Adaptation	Future Implications
1	Y	Corporates are looking for access to Innovation that they cannot create in-house; Fewer institutional investors in the market	Cyclical	Hasn't adapted as a firm; historically doesn't do many investments along side CVCs	DNA
2	Y	Corporates are looking for access to Innovation that they cannot create in-house	Long Term	Currently benefiting from having more investors with whom to co-invest	Good for the energy technology market
3	Y	Corporates are looking for access to Innovation that they cannot create in-house	Long Term	Benefiting from having CVCs because they don't have to worry as much about the portfolio company running out of money	DNA
4	Y	It depends: some for greenwashing, others for acquisition of innovation	Cyclical	CVCs are less predictable, which makes adapting in a uniform way difficult	CVC are unpredictable and have misaligned incentives. However, it is helpful to have them fill the gap and come in prior to exit. Institutionals would have serious issues in getting companies to exit without the corporate investors playing a role
5	Y	Corporates are looking for access to Innovation that they cannot create in-house. R&D is useful for certain technologies, but they realize that R&D is not always the best vehicle to bring in all innovations.	Either Long Term or Cyclical	It's a positive change - as the number of institutional investors decrease, it is meaningful for the CVCs to step in and pick up the slack. However, CVCs bear unpredictability.	Expecting an increase in Innovation
6	Y	Corporates are looking for access to Innovation that they cannot create in-house	Cyclical	Corporates being in the space is proving to be very valuable to institutional investors	Each time we do a round with a CVC, it helps to build relationships, which is good for the sector. However, it is hard to co-invest with a CVC because they are slow and unpredictable
7	Y	Corporates are looking for access to Innovation that they cannot create in-house	Cyclical	DNA	DNA
8	Y	Corporates are looking for access to Innovation that they cannot create in-house	Long-Term	Now start-up companies specify and actively look to raise a strategic round with a CVC	Vintage 2010 funds will likely do better because of more attractive valuations. Bigger exits for these funds creates positive publicity and has a cyclical effect. But this will stabilize a bit. Also, from the perspective of a CVC, the institutional investors seem more open to co-invest with CVCs than they were even 5 years ago.

**Table 3: Trend 1 interview responses, by investor. \*DNA: did not answer due to time constraints or efforts to keep the interview conversational.**



## Trend 2 Responses

Trend 2: Decreasing Number and Size of Energy Technology Deals					
Investor	Agree? (Y/N)	Driver	Timeline	Adaptation	Future Implications
1	Y	Poor returns for investors	Cyclical	DNA	DNA
2	Y	Limited amount of capital targeting the space right now	DNA	Shifting to investing in startups on the demand side vs. supply side; next fund will focus on less capital intensive investments, and hopefully lead to shorter investment cycles	Could benefit the market in that those firms that make it through this tough time will be the best investors (survival of the fittest); perhaps this also leads to a new trend of finding more ways to produce and manage energy efficiently as opposed to looking for ways to extract it
3	Y	VCs that are still in the game prefer more capital efficient plays (thus by definition, deal size is coming down)	DNA	DNA	DNA
4	Y	DNA	Long term, specialists are here to stay. Generalists will stay away	DNA	DNA
5	N	Disagreed with existence of this trend.	DNA	DNA	DNA
6	Y	All of the above: negative PR leads to less capital in space which leads to a decrease in both the number and size of deals	Cyclical	More cognizant of financing risk in follow-on investments, so have diversified the portfolio a bit	(1) Market size/opportunity is more attractive than ever (downstream solar and project financing). (2) Pre-financial crash investment in Cleantech tended to be in companies that were more linked to manufactured goods with higher capital costs. In the last 2 -3 years, have seen a more rapid prove-out of value-add leading to more capital efficient deals. This is part of a cycle. This will leave good opportunities out on the table. (3) Venture (as a whole) has been overinvested by pension funds, endowments, etc. This leads to an unsustainable increase in the number of VCs. We are now simply seeing a slight correction (mean-reversion) of this trend.
7	Y	(Unclear Response)	Cyclical	DNA	DNA
8	Y	Unattractive exit opportunities	Cyclical	We have actually increased our number of deals	DNA

Table 4: Trend 2 interview responses, by investor. \*DNA: did not answer due to time constraints or efforts to keep the interview conversational.

## Trend 3 Responses

Trend 3: Difficulty Raising Funds					
Investor	Agree? (Y/N)	Driver	Timeline	Adaptation	Future Implications
1	Y	Lack of proven returns	Short term	n/a - hasn't affected firm	DNA
2	Y	Lack of proven returns	Depends on the exits that occur in the next 5 years. If we see large exits, this may just be a short-term trend.	n/a - hasn't affected firm	DNA
3	Y	All of the above, but most of all poor returns	DNA	DNA	DNA
4	Y	Lack of proven returns	Long-term	DNA	Less money chasing better deals, so will see slower margins of legitimate exits over time
5	Y	High capital costs. The ones having most trouble in raising their next fund are those that previously invested high amounts of capital in startups that are trying to replace a commodity. In addition, the fund raising environment right now is out of favor for VC in general.	DNA	DNA	DNA
6	Y	Migration away from the space by pension funds and endowments	Cyclical	n/a - hasn't affected firm	Darwinism; survival of the fittest
7	Y	Lack of returns and negative PR. Additionally, the sector hasn't been around long enough to have enough experts	Cyclical	n/a - hasn't affected firm	DNA
8	Y	Poor returns & high capital costs of investments	Cyclical	n/a - hasn't affected firm	DNA

**Table 5: Trend 3 interview responses, by investor. \*DNA: did not answer due to time constraints or efforts to keep the interview conversational.**

## Discussion

Lending validity to our basis for this research, we were pleased to find that every investor agreed with our three identified sector trends, with the exception of Investor #5 disagreeing with Trend 2. We later followed up with Investor #5, providing our findings from outside reports (see Table 1).

### Trend 1

According to the above findings, most investors interviewed (seven out of eight) agreed that the main driver of corporates increasing venture capital investment in energy technology is due to their desire to access innovation that they are unable to create in-house. Investor #4 also noted that for some corporations, these investments act as a form of “green washing” – performing acts of sustainability solely to boost public image.

None of the investors thought this trend would be short-term, as research subjects were split nearly 50/50 between long-term and cyclical. Some investors prefer not to invest alongside corporate venture capital firms because they believe incentives related to carry, strategic insights, and exit targets are not aligned. Others mentioned that CVCs are slow and unpredictable (Investors 1 and 4). Still, some investors saw this as a positive trend for the industry. Future implications mentioned include an expectation for growing innovation and stronger relationships with strategic investors.

The most conservative view on investing with CVCs interestingly came from the family office investor. A possible explanation could be that family offices typically invest small amounts relative to a large strategic partner, and thus are more exposed to the slow and unpredictable nature of CVCs. In terms of misaligned incentives mentioned by Investor #4, it was noted that corporations tend to be known for more frequently changing outlooks, investments, management and employees. In comparison, institutional VCs typically operate on eight to ten-year investment cycles and rarely see partner turnover.

Another investor added that it is beneficial to have more than one corporate investor in each deal to mitigate the risk of moving too slowly, because one CVC can pressure the other to move “normal slow rather than really slow.”

For Trend 1, there did not appear to be a significant difference in responses attributable to geography of each investor.

## **Trend 2**

Not all investors fully agreed that the number and size of deals being done in the energy technology space is decreasing. Investor #5 outright disagreed, explaining that he actually was seeing a rebound in deal frequency over the last quarter.

Investor #1 qualified his response, noting that he believed the overall trend was

true for energy technology as we have defined it (see page 7), if you remove natural gas technologies from the equation. Investor #7's response remained unclear.

Given this slight hesitation to agree with Trend 2, investor responses varied widely with regard to drivers, length, adaptation strategy, and future implications of this trend. In addition, many investors opted out of responding to follow-up questions related to Trend 2.

Investor #2 offered unique insight on where the energy technology market is going based on decreasing deal frequency, higher capital costs, and an overall unattractive investment environment: demand-side solutions. Many demand-side management (DSM) solutions, such as energy management software and demand response, can require less investment than commercializing battery technology or manufacturing hybrid vehicles. Investor #3 also pointed to a preference for more capital-efficient investments driving decreased deal size because, by definition, less investment is required for those deals. Investor #6 also hinted at this changing dynamic in discussions around portfolio diversification within the sector, pointing more toward downstream solutions. For example, third-party solar financing has attracted a large amount of VC investment in startups, such as Clean Power Finance, OneRoof, and Vivint Solar, as well as interest from the public markets (e.g. SolarCity IPO in December 2012). According to GTM Research, the U.S. solar financing market is expected to grow from \$1.3 billion in 2012 to \$5.7 billion in 2016 (Wesoff, 2013).

Most interestingly, while Investor #8 (a CVC) acknowledged the existence of Trend 2, the investor stated that the firm represented had actually increased the number of deals in the sector, further validating Trend 1.

Due to many of our interview questions related to Trend 2 remaining unanswered, we cannot draw significant conclusions related to differences in attitudes with respect to firm location or type. Of those that commented on the expected timeline of this trend, four of five investors noted the cyclical nature of Trend 2, and hypothesized that the investing environment for energy technology will indeed see increased activity again. In the opinion of Investor #6, while the volume of deals has come down from its peak, higher quality management teams have emerged in the space – a “survival of the fittest” – which will eventually lead to better investment opportunities and higher returns.

### **Trend 3**

Many investors feel that difficulty raising new funds stems from the lack of decent returns in the space. These investors mentioned that the negative public image associated with energy technology investing is due to big changes in the early stage investment space overall. In the early 2000's, generalist investors started making investments in the energy technology space. Most expected that these investments would perform similarly to the early stage investments to which they had become accustomed in the technology space, realizing exits and seeing returns in just three or four years. Additionally, these investments had previously required relatively

low capital costs in order to scale. However, we now know that these assumptions in energy technology applications were misinformed. Returns turned out to be unimpressive, and many high-profile companies failed. According to the vast majority of our research subjects (seven out of eight), these failures led to an overall negative stigma toward early-stage energy technology investments. In interviews, many investors specifically cited poor returns from early upstream solar investments, such as Solyndra and MiaSole.

It should be noted that while each investor acknowledged and justified the existence of Trend 3, none admitted to experiencing difficulty in raising funds firsthand. Five investors responded that this trend has not affected their fundraising goals and capabilities, and three investors did not comment one way or the other.

### Comparison to Biotech

Research subjects were specifically asked to focus on trends as they apply to energy technology. We did not explicitly ask them about related trends in other sectors in which they might also invest. After conducting these eight interviews, however, we wanted to better understand if these results could be extended and applied to other industry sectors within venture capital.

We briefly compare these trends in energy technology to the biotech space, given the similar “niche” quality and size of investment (the sector received 25% of all venture capital investment in 2012 – see figure 5). According to one former

investment analyst, the biotech and energy technology sectors are indeed similar in attracting CVCs that strive to acquire emerging innovation (Onovakpuri, 2013). Pharmaceutical companies have employed venture capital arms for decades in order to complement their internal R&D efforts (Bielesch, Brigl, Khanna, Roos, & Schmieg, 2012). A major difference, however, is the lack of diversified CVC investors in biotech. Whereas energy technology draws CVC interest from a variety of industries (see page 16), the vast majority of CVC interest in biotech comes directly from the pharmaceutical industry. From July 2010 to June 2012, 96% of CVC investments by healthcare corporations (including big pharmaceuticals like GlaxoSmithKline and Pfizer) targeted healthcare and biotech startups (Bielesch, Brigl, Khanna, Roos, & Schmieg, 2012)<sup>1</sup>. Chemical CVCs also target the space, but to a much smaller extent. For comparison, energy technology received 52% of industrial CVC investment, 37% of chemical CVC investment, and 22% of CVC investments by conglomerates (Bielesch, Brigl, Khanna, Roos, & Schmieg, 2012). This shows that while the CVC investment trend may exist across other sectors, energy technology is still unique in its attractiveness to many industry segments and players. This could indicate a larger and/or longer lasting impact of Trend 1 for energy technology investors relative to other sectors.

Additionally, biotech serves as a niche field within venture capital. Similar to energy technology, generalist VCs started investing in biotech without the industry expertise, expecting to see returns and investment cycles similar to those of pure

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<sup>1</sup> We acknowledge that healthcare and biotech are indeed separate sectors, however, most reliable data on CVC investment aggregates these two sectors under a general “healthcare” umbrella.



technology plays (Onovakpuri, 2013). As biotech return cycles proved to be years longer than expected, many VCs did not survive or were forced to take losses. Successful biotech VCs are now run by industry experts and PhDs (Onovakpuri, 2013). We expect to see a similar shift in energy technology venture capital firms, given the current difficult fundraising environment, and need for industry expertise.

## Policy Landscape

While a deep-dive into the policy landscape for early-stage investment in energy technology is outside the scope of this project, we must acknowledge and emphasize the hugely uncertain regulatory environment that affects investment decisions. According to a recent Pew study, selected industry experts cited “a lack of policy certainty as the overriding impediment to investment and success” (The Pew Charitable Trusts, 2012). Uncertainty exists around national renewal of the wind production tax credit (PTC), CAFÉ standards for vehicle fuel efficiency, and investment tax credits (ITC) for solar project developments. State-by-state regulatory environments differ as well, causing further confusion and uncertainty for VCs in terms of market size, profitability, competitive landscape, and the path to commercialization. For example, California’s Self-Generation Incentive Program provides rebates to customers purchasing distributed fuel cells and small wind turbines from California manufacturers (California Energy Commission, 2013). California also employs multiple statewide solar initiatives and uses ARRA funds to support home energy efficiency retrofits (U.S. Department of Energy, 2013). Due to these uniquely friendly policies, many opportunities are not scalable outside of

California, limiting attractiveness to investors. We believe the key for entrepreneurs will be to build a scalable business model that can succeed regardless of incentive programs in order to attract venture capital investment.

## Additional Considerations

It is inevitable, when conducting phone interviews, that research subjects may interpret questions differently, and thus provide varying responses. For example, while only Investor #5 stated an outright disagreement with Trend 2, Investors #1 and #7 may have somewhat disagreed as well (see page 33), although this remains unclear. Additionally, after aggregating and analyzing interview responses, there remain a number of unanswered questions that should be addressed in the future to provide a clearer picture of the early-stage energy technology investing environment. We recommend the following non-exhaustive list of adjustments to our study, and potential next steps:

- Provide a written survey or list of questions in addition to conducting a phone interview to more clearly convey the intention of research.
- Conduct a survey with a larger sample size of funds, including more family offices and corporate investors, as well as a better geographical balance.
- Conduct research on a global scale to understand the differences between U.S. energy technology venture investment and that of other nations.
- Develop a follow-up communications plan to fill gaps in research (for example, to address the lack of responses related to Trend 2).
- Question investors about other trends they are seeing in the market that we had not discussed or addressed in our survey.

- Broaden this study to include other types of asset managers in order to compare attitudes and observations across investment scope, stage, and timeline to exit.
- Develop additional survey questions related to policy implications in the sector.

## Conclusion and Future Outlook

In analyzing and understanding the major trends, drivers, time horizon, and future implications of our identified trends in early-stage energy technology investing, we emerge with three main take-aways and an overall optimistic view of the sector:

1. **Attitudes toward increasing CVC involvement vary based on firm size and focus.** Smaller firms may be concerned with the overwhelming influence of large corporates, which move slowly and act unpredictably over a traditional VC timeframe. Firm type and size also influence adaptation and risk mitigation strategies for working with CVCs. Overall, corporates will continue to play a large role in the space, and firms will adapt accordingly.
2. **Unattractive market dynamics are pushing funds to focus more on downstream investments,** such as energy efficiency, demand side management tools and marketplaces, innovative financing solutions, and other business model innovations. Upstream technology innovations can quickly become commoditized as solar panels did with increased Chinese manufacturing competition (see page 13). Investing in upstream solutions does not align as well with institutional venture capital investment needs and cycles.
3. **Trends 1, 2, and 3 are all interconnected.** Due to the early nature of how VCs allocated funds in energy technology, investors became thinly spread over a number of deals. Generalists entered the energy technology space, expecting

similar return profiles to their previously completed deals in IT and Software. As high capital cost projects fell through, the sector gained a poor reputation, leading to difficulty raising funds and an increased interest in more capital-efficient deals. Where traditional VCs have been pushed out of the sector, CVCs have found room to step into the early-stage investment landscape, which will drive more innovation in the sector and hopefully allow for a rebound in energy technology venture capital.

Given the above take-aways, and the overall positive tone of investors we spoke to, we do anticipate shifts in the investment style of venture capital firms, but remain optimistic about opportunities in early-stage energy technology investing overall. We expect venture capital firms in the space to diverge. As seen in biotech, some firms will likely specialize in energy technology and find success in technology innovations given their expertise. Other more generalist firms will be forced to focus more on capital-efficient investments in downstream energy technology innovations, where they can achieve investment cycle and return profiles similar to pure technology plays. Gaps in funding can be filled by newly interested CVCs, which can provide strategic advantages to start-ups and help spur a new wave of innovation. Global energy demand is rising, and entrepreneurs will continue to discover innovative resource solutions. If early-stage energy technology investors can fully understand the major trends and drivers discussed in this project, we are optimistic they can achieve significant returns in the space for years to come.

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## Glossary

We define the following terms given the context of energy technology venture capital investing and the context of this Master's Project. Some of these definitions apply only to this report, and may vary across other resources.

- **Acquisition:** The purchase of a company's ownership stake (most, if not all) by a corporation, in order to take control of that company.
- **CAFÉ standards:** The CAFE (Corporate Average Fuel Economy) standard is in place to reduce energy consumption of cars by increasing their fuel economy. It dictates a standard minimum average fuel economy of cars sold in the U.S.
- **Carry:** When a firm makes a profit from exiting an investment, the firm returns a share of those profits – known as the carry, or “carried interest” – to its partners. Likewise, if a firm makes a series of investments from a fund, a percentage of the overall return on the fund is also called the carry.
- **Exit:** An event in which a venture capital firm sells its ownership stake in a portfolio company. This is typically through an IPO or acquisition by another company.
- **Generalist Investors:** Investors seeking returns from multiple sectors.
- **Investment Tax Credit (ITC):** A tax credit provided by the government for investments in particular industries in order to encourage growth. In the context of this paper, an ITC typically refers to investments in solar and other cleantech projects.
- **Initial Public Offering (IPO):** An event in which a privately funded company ‘goes public’ by selling shares of the company stock to the public, and can then be publicly traded on an exchange.
- **Liquidity Event:** In the context of this report, an event in which a firm exits an investment in exchange for cash or sells a piece of their ownership stake in a portfolio company in exchange for cash.
- **Portfolio Company:** When a venture capital firm invests money from a fund in a company (usually an early-stage company or startup), that company is referred to as a portfolio company because it is now part of the venture capital fund's portfolio of investments.

- **Production Tax Credit (PTC):** A tax credit provided by the government for the production of electricity by renewable resources (wind, biomass, hydropower, solar, geothermal, marine and hydrokinetic).
- **Seed Round:** A early-stage company's first financing round in which funds raised are used to start the business. The seed round is sometimes referred to as a "friends and family" round, because the capital is often raised from the founders' friends and family. Seed rounds are usually small and raised early on in the company's lifecycle in its conceptual or idea stage.
- **Series A Round:** Occurs after or in place of a seed round, and is the first major source of capital for a young company. Venture capital funds, angels, and independents are the typical investors in a Series A round. Usually, the capital is provided in exchange for convertible preferred stock.
- **Series B Round:** Occurs after a Series B round of financing. It is rare that angels would invest during this stage of funding. Series B, C, D, and beyond are typically funded by venture capitalists or growth equity investors.
- **Strategic Investors:** Corporate or independent investors that add value to the portfolio company through strategic partnerships and introductions to key stakeholders within the company's industry. These types of investors are key to any company, but especially to energy technology companies.
- **Third-party financing:** An increasingly popular and lucrative way to finance renewable energy generation, especially in the solar industry. Generally, third-party financing refers to an entity taking part in a funding transaction that is not one of the principals in order to take advantage of tax credits, allow for leasing programs, and lower costs for the end customer.